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MOTIVATION OF R&D ENTREPRENEURS: DETERMINANTS OF COMPANY SUCCESS(1)

Herbert A. Wainer and Irwin M. Rubin

January, 1967 #234-67

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Motivation of R&D Entrepreneurs: Determinants of Company Success

by

Herbert A. Wainer* and Irwin M. Rubin+

ABSTRACT

Eighteen technical entrepreneurs were studied focusing upon the relationships between their motivation and company performance. More specifically, the relationships between the entrepreneurs' need for achievement, need for power, and need for affiliation were related to the performance of the eighteen small companies they founded and operated. The results indicate that the entrepreneurs' need for affiliation is not a significant factor in determining company performance. However, high need for achievement and moderate need for power are associated with high company performance. High need for achievement seems to be a necessary condition for high performance whereas moderate need for power seems to make it more probable. The influence of need for power on performance seems to be derived through its determination of leadership styles. High need for power appears to be indicative of an authoritarian and low need for power indicative of a laissez-faire style of leadership. On the other hand moderate need for power seems to be indicative of a democratic style of leadership. In certain situations the most effective leadership style is democratic and performance of groups controlled in this manner is better than groups controlled by either of the other two styles.

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INTRODUCTION

Numerous attempts have been made to identify those personality traits which differentiate leaders from non-leaders or effective leaders from ineffective leaders. These studies have, in general, failed to find any consistent pattern of differentiating traits. In a broad sense, the present research is analogous to these prior efforts in that it seeks to explain company performance on the basis of certain personality characteristics of the president. Several steps were taken, however, to anticipate two potential problem areas that Gibb suggests are possible reasons for the inconsistent results of prior studies:

> (1) Personality description and measurement themselves are not yet adequate. Reliable means of measuring basic personality dimensions are still needed. It may be that in leadership researches the really significant aspects of personality have not yet been investigated. (2) The groups studied have usually been markedly different from one another and this may have had the effect of concealing a relation between personality and the excercise of leadership within a more homogeneous set of groups or family of situations. (Gibb, 1954)

The major personality variable of interest in the present study was need for achievement. The specific aim was to test McClelland's macro theory of economic growth at the micro level of organizational performance. There seemed little doubt, in view of the existing body of prior research, that McClelland's version of the Thematic Apperception Test (T.A.T.) provided a reliable means of measuring the personality trait of primary interest. (McClelland, 1961; Atkinson, 1958)

With respect to the second problem area, a very homogeneous set of groups or family of situations have been examined. In effect, this means that the potential influence of the "situation" has been mitigated thereby increasing the probability of finding a relationship between the leader's personality and company performance. Clearly, if one sought to explain variations in company performance on the basis of the president's need for achievement, the situations studied would have to be such that:

(1) the need (if it should exist) could manifest itself in concrete behavioral terms and,

(2) this behavior would be capable of making a real difference in terms of company performance.

It would be surprising, indeed, to find a relationship between the profits of companies like General Motors and their presidents' need for achievement.

For these reasons, the focus in this study was upon the new, small, technically-based enterprise. The entrepreneur-president of such a company has placed himself in a situation where his need for achievement, if it exists, can be readily translated into concrete behavior. He starts the company, hires people and motivates them, sells, plans, takes risks, and so on. It is his personality and motivation that molds the company in its every aspect. Furthermore, in such situations, the entrepreneurs' efforts and decisions are likely to be very important in determining the initial success of the venture.

DEFINITION OF NEEDS MEASURED AND SPECIFIC HYPOTHESES

Need for achievement (n-ach) does not lend itself to a simple definition but can best be understood in terms of distinguishing characteristics of people classified as high vs. low. Individuals high in n-ach tend to take moderate as opposed to high or low risks. In addition, they usually perform better at tasks which are moderate in risk. Both low and high risk are not achievement oriented situations because of either ease or impossibility of accomplishment. On the other hand moderate risk tasks can be accomplished in an innovative manner through the efforts of the achieving individual. High n-ach individuals tend to choose and work hard at tasks in which they can achieve in personally determined novel or innovative ways. Their high n-ach does not lead them to work hard and perform well at merely anything.

The high n-ach individual has to have concrete feedback on his actions and must perceive that the end result is at least in part due to his actions. The implication here is that the concrete feedback is external to the individual, i.e. profits from his business rather than personal satisfaction that he is a good manager. As McClelland points out, however, money and profits do not have intrinsic interest for the high n-ach individual. Instead, "Money, to them, was the measure of success. It gave them the concrete knowledge of the outcome of their efforts that their motivation demanded." (McClelland, 1961, p.237)

The association of high n-ach with the choice of entrepreneurship as a career also follows from the above. Clearly, inherent in the entrepreneurial situation are most of the characteristics which may satisfy individuals high in n-ach. (McClelland, 1961)

Need for Power (n-pow) is "that disposition directing behavior toward satisfactions contingent upon the control of the means of influencing another person. In the phenomenal sphere of the power-motivated individual he considers himself the 'gate keeper' to certain decision-making of others. The means of control can be anything at all that can be used to manipulate another person." (Atkinson, 1958, p.105)

Need for Affiliation (n-aff) is concerned with the establishment, maintainence, or restoration of positive affective relationships with other people. These relationships are most adequately described by the word friendship. Statements of liking or desire to be liked, accepted, or forgiven are manifestations of this motive. (Atkinson, 1958) Feedback is implied in that the individual who is high in need for affiliation has to have the internal feeling that he is liked or accepted. Note that this is feedback of a different sort than one might expect to be necessary to an individual high in n-ach.

The major hypothesis to be tested concerns the relationship between an entrepreneur's level of n-ach and his company's performance. More specifically, given that an individual becomes an entrepreneur (thereby placing himself in a situation capable of satisfying high n-ach individuals), the performance of his company is directly related to his level of n-ach.

In addition, the authors were interested in the relationship among the three needs (n-ach, n-aff, and n-pow) and how their joint product affected performance of the companies under study. The inquiry in this form was stimulated by McClelland's discussion of the joint product of n-pow and n-aff in relation to dictatorship. (McClelland, 1961) He found that n-pow was not related to economic growth but was related to style of lead-

ership. More specifically, the combination of a high n-pow and a low n-aff was associated with the tendency of a country to resort to totalitarian methods as a style of leadership. The implication is that high n-pow leads to authoritarian control in which there is little concern for people in general unless the n-pow is checked by a high n-aff as is the case in the United States.

METHODOLOGY

Eighteen small research and development companies in the Boston area were selected for study. They ranged in activities from service to manufacture of proprietary products. All companies are ten years old or less. (Schrage, 1965) Company and entrepreneurial-personality information were gathered from the entrepreneur-president. Among the information collected were company profit and growth figures and the McClelland version of the Thematic Apperception Test (T.A.T.) for each entrepreneur. The profit and growth figures were used as measures of performance. They are defined in detail below. The T.A.T.'s were scored for n-ach, n-pow, and n-aff by the Motivation Research Group at Harvard University in Cambridge, Massachusetts. The resulting scores[(2)] were the basis for the analysis of the strength of various needs in relation to performance.

The two company related indices used as measures of success are as follows: Average percent profit or loss on sales measured during the reported history of the company (profit). The authors realize that the wide

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[2] Average intercoder reliabilities of scorers from the Motivation Research Group are in the high 0.80 range.

range of techniques used by research-based enterprises (as well as small, one-owner companies in general) in reporting profits requires great caution in the use of such a measure. As a result the profit figures were adjusted as follows. All amounts spent on proprietary research or development but capitalized were subtracted. Also, the difference between the salary paid to the president and what would have been paid to a stranger holding the same job was added or subtracted. (Schrage, 1965)

Annual increase in the logarithm of sales volume between the second and most recent year reported (Growth Rate). The easiest way to understand this measure is to consider an example. Company A is seven years old. Its second year sales were $100,000 and its last year (seventh) sales were $950,000. These two sales values are plotted on semi-log paper. The Growth Rate is indicated by the percent rate of change from year to year. This is, of course, constant over the seven years. The Growth Rate in this case would be approximately .56.

Profit and Growth Rate were highly correlated (Tau = .39, p (1-tail) = .01, N = 18). Both measures are used independently throughout this paper. The authors' purpose in this procedure is to attempt to lend more credibility to the results by showing consistent trends and relationships with two measures of performance. Although they are strongly related, the correlation is not perfect. A summary of all variables measured appears in Table 1.

TABLE 1

Means, Medians, and Ranges of Variables Measured

VARIABLE	MEAN	MEDIAN	RANGE
N-ACH	4.5	4.5	-5 to 14
N-AFF	2.9	2.5	0 to 6
N-POW	3.7	3.0	0 to 10
PROFIT	-3.1	0.4	-50 to 29
GROWTH RATE	.50	.44	0 to 1.32

RESULTS

It is important to emphasize at this point that hypothesis testing was based on a very small sample of data. To deal most effecitvely with this problem, one of the most powerful of the non-parametric statistical tests, the Mann-Whitney U test, was used for all analyses. In creating subgroups for these analyses, comparability of sample sizes was the guiding decision rule. Where a large number of tied observations rendered this decision rule impossible, tied scores were randomly distributed into adjacent subsamples.

Relationship Between Needs

The first question of interest concerns the nature of the relationship among the three needs; n-ach, n-aff, n-pow. N-aff was found to be unrelated to n-pow but negatively related to n-ach. (See Table 2). In other words, the higher one's need for affiliation, the lower one's need for achievement.

Table 2

Relationship Between N-aff vs N-pow and N-ach

(N=18)

	N-aff		
	Hi (≥ 4.0) (N=7)	Med ($1 > x < 4$) (N=5)	Lo (≤ 1.0) (N=6)
N-ach	$1.9^{(a)}$	$2.6^{(b)}$	$7.5^{(c)}$
N-pow	$3.9^{(d)}$	$4.0^{(e)}$	$3.2^{(f)}$

Mann-Whitney U Tests:

N-aff vs N-ach; (a) vs (b), $p < .27$
(a) vs (c), $p < .05$
(b) vs (c), $p < .27$

N-aff vs N-pow; (d) vs (e), $p < .31$
(d) vs (f), $p < .21$
(e) vs (f), $p < .47$

A somewhat surprising phenomenon appears in the relationship between n-ach and n-pow. A moderate level of n-ach is associated with a higher level of n-pow than either a high or low level of n-ach. (See Table 3). There appears, in other words, to be a curvilinear relationship between n-ach and n-pow.

Table 3

Relationship Between N-ach vs. N-pow

(N=18)

	N-ach		
	Hi (≥9.0) (N=5)	Med (0>x<9) (N=7)	Lo (≤0) (N=6)
N-pow	2.8(a)	5.6(b)	2.2(c)

Mann-Whitney U Test:

N-ach vs N-pow; (a) vs (b), $p < .09$
(a) vs (c), $p < .37$
(b) vs (c), $p < .04$

Relationship Between Needs and Measures of Performance

The major hypothesis in this study predicted a positive relationship between an entrepreneur's level of n-ach and his company's performance (profits and growth rate). The hypothesis, in that form, could not be substantiated.(3) There appears, instead, to be a J-shaped relationship between n-ach and company performance; large losses and low growth rate are associated with moderate n-ach. This non-linearity appears only mildly in the relationship between n-ach and profit but is quite marked in the relationship between n-ach and growth rate. (See Table 4)

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3 Kendall Tau n-ach vs profit = .2067, p (1-tail) = .13
Kendall Tau n-ach vs growth rate = .1070, p (1-tail) = .26

Table 4

Relationship Between N-ach and Measures of Company Performance

(N=18)

	N-ach		
	Hi (≥9.0) (N=5)	Med (0 > x < 9) (N=7)	Lo (≤0) (N=6)
Profit	9.7(a)	-9.2(b)	-6.6(c)
Growth Rate	0.76(d)	0.29(e)	0.45(f)

Mann-Whitney U Tests:

N-ach vs Profit; (a) vs (b), $p < .02$
(a) vs (c), $p < .03$
(b) vs (c), $p < .27$

N-ach vs Growth Rate: (d) vs (e), $p < .001$
(d) vs (f), $p < .04$
(e) vs (f), $p < .06$

The fact that there also appeared to be a non-linear relationship between n-ach vs. n-pow (See Table 3), led to an examination of the relationship between n-pow and company performance. Although the levels of significance achieved are below acceptable limits, the pattern observed is suggestive of a curvilinear relationship between n-pow and company performance; large losses and low growth rate are associated with both high and low n-pow. (See Table 5) Furthermore, when the extreme low (0.0) and high (≥5.0) n-pow groups taken together (N=9) are compared with the moderate n-pow group (N=9), the moderate group is significantly more profitable.[4]

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[4] Extreme n-pow, profit = -9.4; Moderate n-pow, profit = 3.2; Significance of difference, $p < .06$, Mann-Whitney U-test.

TABLE 5

Relationship Between N-pow and Measures of Company Performance

(N=18)

	N-pow		
	Hi ($\geq$4.0) (N=6)	Med (2.0$>$x$\leq$4.0)* (N=6)	Lo (0$<$x$\leq$2.0)* (N=6)
Profit	-6.0[a]	6.4[b]	-9.7[c]
Growth Rate	0.38[d]	0.65[e]	0.39[f]

Mann-Whitney U Tests:

N-pow vs Profit; (a) vs (b), $p < .12$
(a) vs (c), $p < .41$
(b) vs (c), $p < .16$

N-pow vs Growth Rate; (d) vs (e), $p < .09$
(d) vs (f), $p < .41$
(e) vs (f), $p < .12$

*Several scores were tied at 2.0. These were randomly distributed among the Med and Lo groups.

In the analyses thus far we have focused upon the relative ordering of people within a single need, e.g., high n-ach vs low n-ach. Another approach is to examine patterns of dominance across several needs within a single individual. For this purpose, raw need scores were transformed into standardized scores.[5] An individual was then classified as being either predominantely achievement oriented or power oriented.[6] It is

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5 This was done using standardized norm scores provided by the Motivation Research Group.

6 N-aff was eliminated from this analysis since it was found to be unrelated to either measure of company performance.

possible, in other words, for a person to have been classified as low n-ach, relative to the total sample, and also be classified as achievement oriented relative to his own power orientation.

As expected, those entrepreneurs whose n-ach is greater than their n-pow perform significantly better than their counterparts whose n-pow is greater than their n-ach.[7]

With the limited sample size available, more sophisticated statistical techniques that might help to clarify the relationships between company performance, n-ach, and n-pow are not feasible.

DISCUSSION

The present study utilizes TAT protocols that were gathered and analyzed by Schrage as reported in "The R&D Entrepreneur: Profile of Success". (Schrage, 1965) Reanalysis of his protocols by the Motivation Research Group at Harvard University produces an intercoder reliability for n-ach of .60 (Rank-order correlation) which is not high enough to indicate confidence in either set of scores. Subsequently, the protocols were reanalyzed, again by the Motivation Research Group at Harvard. The intercoder reliability between the two sets of scores for the Motivation Research Group was .94 (Rank-order Correlation). As a result the authors have more confidence in the original Motivation Research Group scores than those used by Schrage. The analysis utilizing the Motivation Research Group scores yields conclusions that are substantially different from those reported by Schrage.

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[7] Predominantly n-ach, median profit = 3.6, N=10; predominantly n-pow, median profit = -1.4, N=8; Significance of difference, $p < .06$, Mann Whitney U Test.

It is useful at this point to consider a hypothetical model of small company performance. Factors which affect performance might be separated into two groups, personality and non-personality. Within each of these two groups are variables which could be called logical whole concepts. In other words there are logical aggregates representing the interaction of several variables which together are reflected in one concept. These aggregates have strong influences on performance. The components of the aggregates also have an effect on performance but one which is less strong. Following this reasoning, a single personality variable such as n-achievement is not a logical whole concept. It is one of the components of the aggregate that might be called active personality. The active personality can be viewed as an intervening variable, determined by the joint product of several single personality factors such as n-ach and n-pow, which directly and strongly affects performance. It is perhaps n-ach tempered and modified by n-pow and other factors which determines the active personality. The entrepreneur's behavior, determined by his active personality, is what directly affects performance. The major consideration is that personality-performance relationships are complex. To some degree this explains why one might not expect to find strong, direct relationships between a single personality factor such as need for achievement and performance.

Analysis of the results of this study indicate, in fact, that more complex relationships do have to be examined if a realistic view of performance determined by personality is to be gained. In the light of the above discussion the absence of a strong positive relationship between n-ach and performance (profit and growth rate) is not too surprising. Instead, a discontinuous relationship was observed as follows. High n-ach

is associated with high performance. However, moderate n-ach is associated with low performance while low n-ach is associated with moderate performance.

It seems reasonable to assume that individuals who are not high in a particular need are motivated or derive their active personalities from other needs. Therefore, while one might observe that high n-ach is associated with high performance, one might not so easily conclude that the rest of the n-ach spectrum is associated in a consistant manner with performance. Insight into the nature of personality-performance relationships for those who do not have a high n-ach might be gained by an analysis of the relationship between performance and other needs. Such an analysis was done by Ramallo in an indirect way when he considered the possibility that the n-ach score indicated two different and separable needs. (Ramallo, 1963)

Ramallo found a related but different concept than n-ach evident in the n-ach score. (Ramallo, 1963) This concept, called value of achievement, might produce different behavior than one would expect if the need for achievement were more pure. Need for achievement drives an individual along a specific path between his present position and the achievement of some goal while value of achievement orients the individual to the goal itself, neglecting the conditions required to get to the goal. In other words a person may value achievement without having the interest or drive to actually achieve. Ramallo found that individuals who scored high in n-ach were predominantly driven by their n-ach. Individuals who were low in n-ach were not driven by either need for achievement or value achievement, but rather presumably by some other need. However, individuals who

had a moderate n-ach score had a large component of value of achievement which perhaps explains their unexpected low performance. This theory is untested and is presented merely to suggest a further explanation of the occurrence of a J-shaped relationship between n-ach and performance.

The analyses focusing upon n-pow yielded results that indicated that need for power was curvilinearly related to performance; moderate n-pow (relative to the study sample) entrepreneurs ran the highest performing companies while both high and low n-pow entrepreneurs ran low performing companies.

One possible explanation for this finding lies in the relationship between n-pow and various styles of leadership. The lower an individual's n-pow, the more permissive or laissez-faire his style of leadership while the higher his n-pow, the more autocratic or authoritarian his style of leadership. The middle of the n-pow spectrum represents a mixed influence of the two extreme styles which is best described by democratic.[8] Prior research (Lippitt and White, 1958) has suggested that in certain situations the most effective leadership style is democratic and that performance of groups controlled in this manner is better than that of groups controlled by either of the other two styles. The authors favor this explanation of the relationship between n-pow and performance because of the nature of the companies studied. All were small and likely to be strongly effected by the behavior of the entrepreneur alone, which gives the companies most of the characteristics of small groups. (Lippitt and White, 1958)

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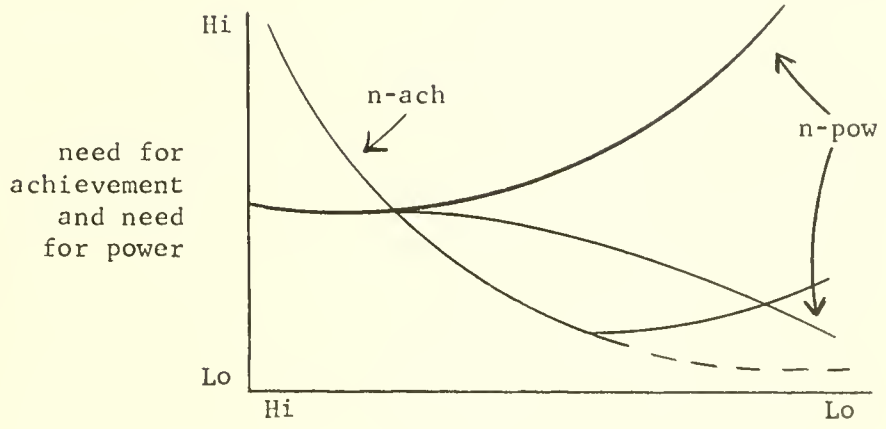
[8] The authors have assumed of course that high n-pow leaders are more likely to exercise an autocratic style of leadership and low n-pow leaders a laissez-faire style.

An attempt was made to shed some light on the multiple effects of n-ach and n-pow by examining the relationship between performance and dominant need patterns. As expected, those companies headed by entrepreneurs whose n-ach dominates their n-pow are significantly more successful than their counterparts who have a converse motive configuration. This finding reinforces the notion that high n-ach is a requirement for high company performance and that high n-pow, particularly when it dominates n-ach, is detrimental to performance.

The analysis of the relationship between n-pow and n-ach indicates that the highest levels of n-pow are associated with moderate levels of n-ach. In the light of the previous discussion relating the lowest level of performance to moderate levels of n-ach and the discussion of dominance patterns, this finding may help to further explain the discontinuous relationship between n-ach and performance. The authors favor the notion that the joint product of n-pow and n-ach has a great deal to do with determining performance. More specifically, n-ach seems to be a critical variable in the determination of small company performance. However, it is n-ach expressed or manifested through the mechanisms determined by the individual's n-pow which produces entrepreneurial behavior which might enhance company performance.

In summary then one might view the two needs, n-ach and n-pow as determinants of small company performance in the following manner. High n-ach and moderate n-pow are associated with high performance. High n-ach seems to be a necessary condition for high performance whereas moderate n-pow seems to make it more probable. Moderate and low levels of n-ach are associated with lower levels of performance, the order of association

being determined by the level of n-pow. These hypothesized relationships are displayed in the following graph.



The analysis of the two needs individually with performance suggests a personality formula for success in business that is not based on one-to-one relationships. It is the interaction effects of several needs that seem to explain performance. The results reported admittedly are based on small sample sizes. However, the pattern of interaction observed is reasonable and consistant with established theory. The only area in which the analysis might be weak is in the use of T.A.T.'s on small sample sizes. The authors recognize this and expect to engage in further examination of the hypotheses suggested and reported in this paper utilizing broader populations.

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